What is claimed is:

1. A modified aluminum oxy compound, which is an aluminum oxy compound that has been modified by reacting with a compound having a hydroxy group, wherein the modified aluminum oxy compound has a ratio of an intensity at 30 ppm(M2) to an intensity at 10 ppm(M1)[M2/M1], in an ^{27}Al-solid NMR spectrum of 0.60 or more.

2. A modified aluminum oxy compound, obtained by a process that comprises reacting:

an aluminum oxy compound(a) having a ratio of an intensity at 30 ppm(H2) to an intensity at 10 ppm(H1)[H2/H1] in an ^{27}Al-solid NMR spectrum of less than 0.35,

water(b), and

a compound(c) having a hydroxy group;

wherein the modified aluminum oxy compound has a ratio of an intensity at 30 ppm(M2) to an intensity at 30 ppm(M1)[M2/M1] in an ^{27}Al-solid NMR spectrum of 0.60 or more.

3. A modified aluminum oxy compound, obtained by a process that comprises reacting:

an aluminum oxy compound(a') having a ratio of an intensity at 30 ppm(L2) to an intensity at 10 ppm(L1)[L2/L1] in an ^{27}Al-solid NMR spectrum of not less than 0.35; and

a compound(c) having a hydroxy group.

4. A modified aluminum oxy compound, obtained by

a process that comprises reacting:

an aluminum oxy compound(a') having a ratio of an intensity at 30 ppm(L2) to an intensity at 10 ppm(L1)[L2/L1] in an ^{27}Al-solid NMR spectrum of not less than 0.35, which is obtained by reacting an aluminum oxy compound(a) having a ratio of an intensity at 30 ppm(H2) to an intensity at 10 ppm(H1)[H2/H1] in an ^{27}Al-solid NMR spectrum of less than 0.35 and water(b); and

a compound(c) having a hydroxy group.

5. The modified aluminum oxy compound according to claim 3, wherein the ratio L2/L1 is not less than 0.35 and less than 0.90.

6. The modified aluminum oxy compound according to claim 4, wherein the ratio L2/L1 is not less than 0.35 and less than 0.90.

7. A modified aluminum oxy compound, obtained by a process that comprises reacting:

an aluminum oxy compound(a") having a ratio of an intensity at 30 ppm(N2) to an intensity at 10 ppm(N1)[N2/N1] in an ^{27}Al-solid NMR spectrum of not less than 0.35 obtained by reacting an aluminum oxy compound(a) having a ratio of an intensity at 30 ppm(L2) to an intensity at 10 ppm(L1)[L2/L1] in its ^{27}Al-solid NMR spectrum of less than 0.35 and a compound(c) having a hydroxy group; and

Water(c).

8. The modified aluminum oxy compound according to

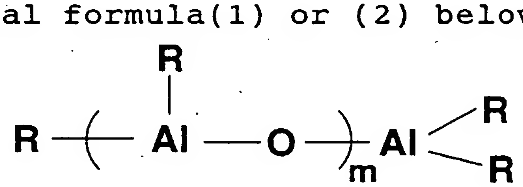
claim 7, wherein the ratio N2/N1 is not less than 0.35 and less than 0.60.

9. The modified aluminum oxy compound according to claim 3, wherein the ratio of the intensity at 30 ppm(M2) to the intensity at 10 ppm(M1)[M2/M1] in the ^{27}Al-solid NMR spectrum is 0.60 or more.

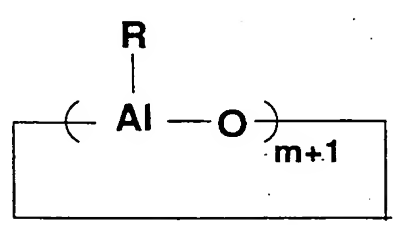
10. The modified aluminum oxy compound according to claim 4, wherein the ratio of the intensity at 30 ppm(M2) to the intensity at 10 ppm(M1)[M2/M1] in the ^{27}Al-solid NMR spectrum is 0.60 or more.

11. The modified aluminum oxy compound according to claim 7, wherein the ratio of the intensity at 30 ppm(M2) to the intensity at 10 ppm(M1)[M2/M1] in the ^{27}Al-solid NMR spectrum is 0.60 or more.

12. The modified aluminum oxy compound according to claim 2, wherein said aluminum oxy compound (a) is an aluminum oxy compound that is soluble in an aromatic hydrocarbon or an aliphatic hydrocarbon represented by the general formula(1) or (2) below:



(1)

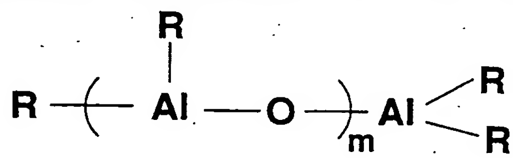


(2)

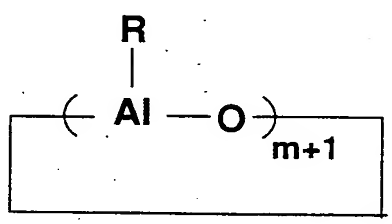
in which R indicates a hydrocarbon group having 1 to 20 carbon atoms, wherein the R groups may be the same

or different; and m represents a number of 1 to 50.

13. The modified aluminum oxy compound according to claim 3, wherein said aluminum oxy compound (a) is an aluminum oxy compound that is soluble in an aromatic hydrocarbon or an aliphatic hydrocarbon represented by the general formula(1) or (2) below:



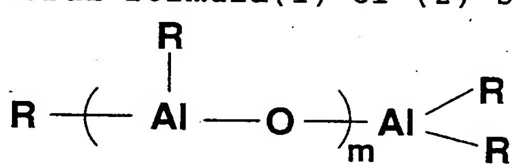
(1)



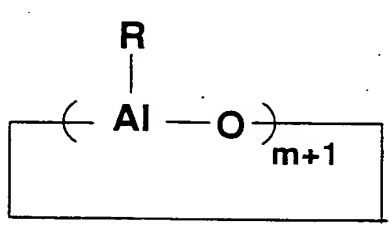
(2)

in which R indicates a hydrocarbon group having 1 to 20 carbon atoms, wherein the R groups may be the same or different; and m represents a number of 1 to 50.

14. The modified aluminum oxy compound according to claim 4, wherein said aluminum oxy compound (a) is an aluminum oxy compound that is soluble in an aromatic hydrocarbon or an aliphatic hydrocarbon represented by the general formula(1) or (2) below:



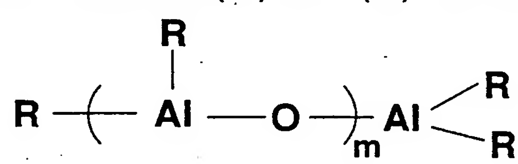
(1)



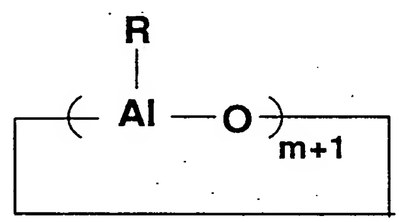
(2)

in which R indicates a hydrocarbon group having 1 to 20 carbon atoms, wherein the R groups may be the same or different; and m represents a number of 1 to 50.

15. The modified aluminum oxy compound according to claim 7, wherein said aluminum oxy compound (a) is an aluminum oxy compound that is soluble in an aromatic hydrocarbon or an aliphatic hydrocarbon represented by the general formula(1) or (2) below:



(1)



(2)

in which R indicates a hydrocarbon group having 1 to 20 carbon atoms, wherein the R groups may be the same or different; and m represents a number of 1 to 50.

16. The modified aluminum oxy compound according to claim 1, wherein said compound having a hydroxy group is an alcohol compound, phenol compound or silanol compound.

17. The modified aluminum oxy compound according to claim 2, wherein said compound(c) having a hydroxy group is an alcohol compound, phenol compound or silanol compound.

18. The modified aluminum oxy compound according to claim 3, wherein said compound(c) having a hydroxy group

is an alcohol compound, phenol compound or silanol compound.

19. The modified aluminum oxy compound according to claim 4, wherein said compound(c) having a hydroxy group is an alcohol compound, phenol compound or silanol compound.

20. The modified aluminum oxy compound according to claim 7, wherein said compound(c) having a hydroxy group is an alcohol compound, phenol compound or silanol compound.

21. A polymerization catalyst component, comprising the modified aluminum oxy compound of claim 1.

22. A polymerization catalyst component comprising the modified aluminum oxy compound of claim 2.

23. A polymerization catalyst component, comprising the modified aluminum oxy compound of claim 3.

24. A polymerization catalyst component comprising the modified aluminum oxy compound of claim 4.

25. A polymerization catalyst component comprising the modified aluminum oxy compound of claim 7.

26. A polymerization catalyst obtained by a process that comprises contacting (A) the modified aluminum oxy compound of claim 1 with (B) a transition metal compound.

27. A polymerization catalyst obtained by a process that comprises contacting (A) the modified aluminum oxy compound of claim 2 with (B) a transition metal compound.

28. A polymerization catalyst obtained by a process that comprises contacting (A) the modified aluminum oxy

compound of claim 3 with (B) a transition metal compound.

29. A polymerization catalyst obtained by a process that comprises contacting (A) the modified aluminum oxy compound of claim 4 and (B) a transition metal compound.

30. A polymerization catalyst obtained by a process that comprises contacting (A) the modified aluminum oxy compound of claim 7 and (B) a transition metal compound.

31. A polymerization catalyst obtained by a process that comprises contacting either:

(A) the modified aluminum oxy compound of claim 1,
(B) a transition metal compound, and
(C) an organoaluminum compound; or
(A) the modified aluminum oxy compound of claim 1,
(B) a transition metal compound,
(C) an organoaluminum compound, and
(D) any one of (D1) a boron compound represented by the general formula $BQ^1Q^2Q^3$, (D2) a boron compound represented by the general formula $G^+(BQ^1Q^2Q^3Q^4)^-$ and (D3) a boron compound represented by the general formula $(L\text{-}H)^+(BQ^1Q^2Q^3Q^4)^-$, wherein B represents a boron atom in the trivalent valence state; Q^1 to Q^3 may be the same or different and represent a halogen atom, a hydrocarbon group, a halogenated hydrocarbon group, a substituted silyl group, an alkoxy group or a di-substituted amino group; G^+ represents an inorganic or organic cation; and $(L\text{-}H)^+$ represents a Brfnsted acid.

32. A polymerization catalyst obtained by a process that comprises contacting either:

(A)the modified aluminum oxy compound of claim 2,

(B)a transition metal compound, and

(C) an organoaluminum compound; or

(A)the modified aluminum oxy compound of claim 2,

(B)a transition metal compound,

(C) an organoaluminum compound, and

(D) any one of (D1) a boron compound represented by the general formula $BQ^1Q^2Q^3$, (D2) a boron compound represented by the general formula $G^+(BQ^1Q^2Q^3Q^4)^-$ and (D3) a boron compound represented by the general formula $(L-H)^+(BQ^1Q^2Q^3Q^4)^-$, wherein B represents a boron atom in the trivalent valence state; Q^1 to Q^3 may be the same or different and represent a halogen atom, a hydrocarbon group, a halogenated hydrocarbon group, a substituted silyl group, an alkoxy group or a di-substituted amino group; G^+ represents an inorganic or organic cation; and $(L-H)^+$ represents a Brfnsted acid.

33. A polymerization catalyst obtained by a process that comprises contacting either:

(A)the modified aluminum oxy compound of claim 3,

(B)a transition metal compound, and

(C) an organoaluminum compound; or

(A)the modified aluminum oxy compound of claim 3,

(B)a transition metal compound,

(C) an organoaluminum compound, and

(D) any one of (D1) a boron compound represented by the general formula $BQ^1Q^2Q^3$, (D2) a boron compound represented by the general formula $G^+(BQ^1Q^2Q^3Q^4)^-$ and

(D3) a boron compound represented by the general formula $(L-H)^+(BQ^1Q^2Q^3Q^4)^-$, wherein B represents a boron atom in the trivalent valence state; Q^1 to Q^3 may be the same or different and represent a halogen atom, a hydrocarbon group, a halogenated hydrocarbon group, a substituted silyl group, an alkoxy group or a di-substituted amino group; G^+ represents an inorganic or organic cation; and $(L-H)^+$ represents a Brfnsted acid.

34. A polymerization catalyst obtained by a process that comprises contacting either:

(A)the modified aluminum oxy compound of claim 4,

(B)a transition metal compound, and

(C) an organoaluminum compound; or

(A)the modified aluminum oxy compound of claim 4,

(B)a transition metal compound,

(C) an organoaluminum compound, and

(D) any one of (D1) a boron compound represented by the general formula $BQ^1Q^2Q^3$, (D2) a boron compound represented by the general formula $G^+(BQ^1Q^2Q^3Q^4)^-$ and (D3) a boron compound represented by the general formula $(L-H)^+(BQ^1Q^2Q^3Q^4)^-$, wherein B represents a boron atom in the trivalent valence state; Q^1 to Q^3 may be the same or different and represent a halogen atom, a hydrocarbon group, a halogenated hydrocarbon group, a substituted silyl group, an alkoxy group or a di-substituted amino group; G^+ represents an inorganic or organic cation; and $(L-H)^+$ represents a Brfnsted acid.

35 .A polymerization catalyst obtained by a process that comprises contacting either:

(A)the modified aluminum oxy compound of claim 7,

(B)a transition metal compound, and

(C) an organoaluminum compound; or

(A)the modified aluminum oxy compound of claim 7,

(B)a transition metal compound,

(C) an organoaluminum compound,and

(D) any one of (D1) a boron compound represented by the general formula $BQ^1Q^2Q^3$, (D2) a boron compound represented by the general formula $G^+(BQ^1Q^2Q^3Q^4)^-$ and (D3) a boron compound represented by the general formula $(L-H)^+(BQ^1Q^2Q^3Q^4)^-$, wherein B represents a boron atom in the trivalent valence state; Q^1 to Q^3 may be the same or different and represent a halogen atom, a hydrocarbon group, a halogenated hydrocarbon group, a substituted silyl group, an alkoxy group or a di-substituted amino group; G^+ represents an inorganic or organic cation; and $(L-H)^+$ represents a Brfnsted acid.

36. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 26.

37. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 27.

38. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 28.

39. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 29.

40. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 30.

41. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 31.

42. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 32.

43. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 33.

44. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 34.

45. A process for producing an olefin polymer, which comprises homopolymerizing an olefin or copolymerizing olefins with the polymerization catalyst of claim 35.

46. A process for producing an olefin polymer according to claim 36, wherein said olefin polymer is a copolymer of ethylene and α-olefin having 3 to 20 carbon atoms.

47. A process for producing an olefin polymer according to claim 37, wherein said olefin polymer is a copolymer of ethylene and α-olefin having 3 to 20

carbon atoms.

48. A process for producing an olefin polymer according to claim 38, wherein said olefin polymer is a copolymer of ethylene and α-olefin having 3 to 20 carbon atoms.

49. A process for producing an olefin polymer according to claim 39, wherein said olefin polymer is a copolymer of ethylene and α-olefin having 3 to 20 carbon atoms.

50. A process for producing an olefin polymer according to claim 40, wherein said olefin polymer is a copolymer of ethylene and α-olefin having 3 to 20 carbon atoms.

51. A process for producing an olefin polymer according to claim 36, wherein said olefin polymer is a homopolymer of 1-butene.

52. A process for producing an olefin polymer according to claim 37, wherein said olefin polymer is a homopolymer of 1-butene.

53. A process for producing an olefin polymer according to claim 38, wherein said olefin polymer is a homopolymer of 1-butene.

54. A process for producing an olefin polymer according to claim 39, wherein said olefin polymer is a homopolymer of 1-butene.

55. A process for producing an olefin polymer according to claim 40, wherein said olefin polymer is a homopolymer of 1-butene.

56. A process for producing an alkenyl aromatic hydrocarbon polymer, which comprises homopolymerizing an alkenyl aromatic hydrocarbon or copolymerizing at least one alkenyl aromatic hydrocarbon and at least one olefin with the polymerization catalyst of claim 26.

57. A process for producing an alkenyl aromatic hydrocarbon polymer, which comprises homopolymerizing an alkenyl aromatic hydrocarbon or copolymerizing at least one alkenyl aromatic hydrocarbon and at least one olefin with the polymerization catalyst of claim 27.

58. A process for producing an alkenyl aromatic hydrocarbon polymer, which comprises homopolymerizing an alkenyl aromatic hydrocarbon or copolymerizing at least one alkenyl aromatic hydrocarbon and at least one olefin with the polymerization catalyst of claim 28.

59. A process for producing an alkenyl aromatic hydrocarbon polymer, which comprises homopolymerizing an alkenyl aromatic hydrocarbon or copolymerizing at least one alkenyl aromatic hydrocarbon and at least one olefin with the polymerization catalyst of claim 29.

60. A process for producing an alkenyl aromatic hydrocarbon polymer, which comprises homopolymerizing an alkenyl aromatic hydrocarbon or copolymerizing at least one alkenyl aromatic hydrocarbon and at least one olefin with the polymerization catalyst of claim 30.

61. A copolymer of at least one alkenyl aromatic hydrocarbon and at least one olefin, having a number average molecular weight of 700,000 or more and a

molecular weight distribution in terms of a ratio (Mw/Mn) of weight average molecular weight(Mw) to number average molecular weight(Mn), of 1.85 to 2.5.

62. An α-olefin polymerization catalyst according to claim 26, wherein the transition metal compound(B) is a transition metal compound having a capability of stereoregular polymerization of an α-olefin.

63. An α-olefin polymerization catalyst according to claim 27, wherein the transition metal compound(B) is a transition metal compound having a capability of stereoregular polymerization of an α-olefin.

64. An α-olefin polymerization catalyst according to claim 28, wherein the transition metal compound(B) is a transition metal compound having a capability of stereoregular polymerization of an α-olefin.

65. An α-olefin polymerization catalyst according to claim 29, wherein the transition metal compound(B) is a transition metal compound having a capability of stereoregular polymerization of an α-olefin.

66. An α-olefin polymerization catalyst according to claim 30, wherein the transition metal compound(B) is a transition metal compound having a capability of stereoregular polymerization of an α-olefin.

67. An α-olefin polymerization catalyst according to claim 62, wherein the transition metal compound having a capability of stereoregular polymerization of an α-olefin is a transition metal compound(b1) represented by the general formula (4) or (5) below:

$$(R^{11}{}_2Y^1)_p\left<\begin{matrix}L^1\\L^1\end{matrix}\right>M\left<\begin{matrix}X^1\\X^1\end{matrix}\right. \qquad (4)$$

or

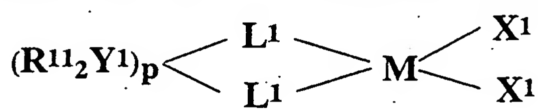
(wherein M is a transition metal atom of the Group IV of the Periodic Table, L^1 is an η^5-indenyl group or a substituted η^5-indenyl group, and two L^1's may be mutually the same or different. Y^1 is a carbon atom, a silicon atom, a germanium atom or a tin atom, each of R^{11} and X^1 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{11} and X^1 may be the same or different mutually. p is 1 or 2.)

$$R^{13}{}_2Y^2\left<\begin{matrix}R^{12}{}_nC_5H_{4-n}\\R^{12}{}_qC_5H_{4-q}\end{matrix}\right>M\left<\begin{matrix}X^2\\X^2\end{matrix}\right. \qquad (5)$$

(wherein M is a transition metal atom of the Group IV of the Periodic Table, Y^2 is a silicon atom, a germanium atom or a tin atom, each of $(R^{12}{}_n\text{-}C_5H_{4-n})$ and $(R^{12}{}_q\text{-}C_5H_{4-q})$ is a substituted η^5-cyclopentadienyl group, and each of n and q is an integer of 1 to 3. The respective R^{12} may be mutually the same or different, and indicate a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group. The position and/or kind of R^{12} in the substituted η^5-cyclopentadienyl group is selected so that a

symmetric plane including M does not exist. Each of R^{13} and X^2 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{13} and X^2 may be the same or different mutually.)

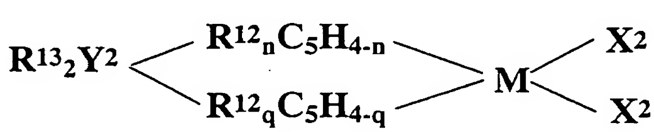
68. An α-olefin polymerization catalyst according to claim 63, wherein the transition metal compound having a capability of stereoregular polymerization of an α-olefin is a transition metal compound(b1) represented by the general formula (4) or (5) below:



(4)

or

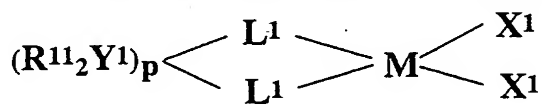
(wherein M is a transition metal atom of the Group IV of the Periodic Table, L^1 is an η^5-indenyl group or a substituted η^5-indenyl group, and two L^1's may be mutually the same or different. Y^1 is a carbon atom, a silicon atom, a germanium atom or a tin atom, each of R^{11} and X^1 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{11} and X^1 may be the same or different mutually. p is 1 or 2.)



(5)

(wherein M is a transition metal atom of the Group Ⅳ of the Periodic Table, Y^2 is a silicon atom, a germanium atom or a tin atom, each of $(R^{12}{}_n-C_5H_{4-n})$ and $(R^{12}{}_q-C_5H_{4-q})$ is a substituted η^5-cyclopentadienyl group, and each of n and q is an integer of 1 to 3. The respective R^{12} may be mutually the same or different, and indicate a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group. The position and/or kind of R^{12} in the substituted η^5-cyclopentadienyl group is selected so that a symmetric plane including M does not exist. Each of R^{13} and X^2 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{13} and X^2 may be the same or different mutually.)

69. An α-olefin polymerization catalyst according to claim 64, wherein the transition metal compound having a capability of stereoregular polymerization of an α-olefin is a transition metal compound(b1) represented by the general formula (4) or (5) below:



(4)

or

(wherein M is a transition metal atom of the Group Ⅳ of the Periodic Table, L^1 is an η^5-indenyl group or a

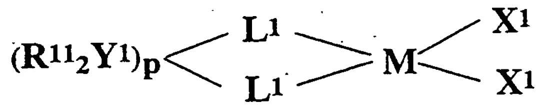
substituted η ^{5}-indenyl group, and two L^1's may be mutually the same or different. Y^1 is a carbon atom, a silicon atom, a germanium atom or a tin atom, each of R^{11} and X^1 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{11} and X^1 may be the same or different mutually. p is 1 or 2.)

$$R^{13}{}_2Y^2 \left\langle \begin{array}{l} R^{12}{}_nC_5H_{4-n} \\ R^{12}{}_qC_5H_{4-q} \end{array} \right\rangle M \left\langle \begin{array}{l} X^2 \\ X^2 \end{array} \right. \qquad (5)$$

(wherein M is a transition metal atom of the Group IV of the Periodic Table, Y^2 is a silicon atom, a germanium atom or a tin atom, each of $(R^{12}{}_n\text{-}C_5H_{4-n})$ and $(R^{12}{}_q\text{-}C_5H_{4-q})$ is a substituted η ^{5}-cyclopentadienyl group, and each of n and q is an integer of 1 to 3. The respective R^{12} may be mutually the same or different, and indicate a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group. The position and/or kind of R^{12} in the substituted η ^{5}-cyclopentadienyl group is selected so that a symmetric plane including M does not exist. Each of R^{13} and X^2 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy

group or a heterocyclic group, and all of R^{13} and X^2 may be the same or different mutually.)

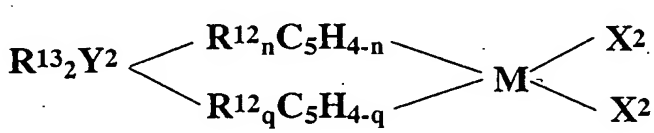
70. An α-olefin polymerization catalyst according to claim 65, wherein the transition metal compound having a capability of stereoregular polymerization of an α-olefin is a transition metal compound(b1) represented by the general formula (4) or (5) below:



(4)

or

(wherein M is a transition metal atom of the Group IV of the Periodic Table, L^1 is an η^5-indenyl group or a substituted η^5-indenyl group, and two L^1's may be mutually the same or different. Y^1 is a carbon atom, a silicon atom, a germanium atom or a tin atom, each of R^{11} and X^1 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{11} and X^1 may be the same or different mutually. p is 1 or 2.)



(5)

(wherein M is a transition metal atom of the Group IV of the Periodic Table, Y^2 is a silicon atom, a germanium atom or a tin atom, each of $(R^{12}{}_n\text{-}C_5H_{4-n})$ and $(R^{12}{}_q\text{-}C_5H_{4-q})$ is a substituted η^5-cyclopentadienyl group, and each of n and q is an integer of 1 to 3. The respective R^{12}

may be mutually the same or different, and indicate a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group. The position and/or kind of R^{12} in the substituted η^5-cyclopentadienyl group is selected so that a symmetric plane including M does not exist. Each of R^{13} and X^2 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{13} and X^2 may be the same or different mutually.)

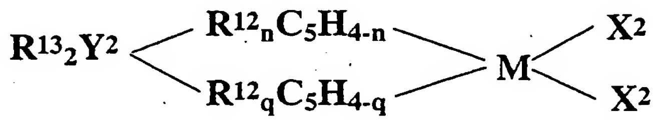
71. An α-olefin polymerization catalyst according to claim 66, wherein the transition metal compound having a capability of stereoregular polymerization of an α-olefin is a transition metal compound(b1) represented by the general formula (4) or (5) below:

$$(R^{11}{}_2Y^1)_p \begin{matrix} \diagup\; L^1 \;\diagdown \\ \diagdown\; L^1 \;\diagup \end{matrix} M \begin{matrix} \diagup\; X^1 \\ \diagdown\; X^1 \end{matrix} \qquad (4)$$

or

(wherein M is a transition metal atom of the Group IV of the Periodic Table, L^1 is an η^5-indenyl group or a substituted η^5-indenyl group, and two L^1's may be mutually the same or different. Y^1 is a carbon atom, a silicon atom, a germanium atom or a tin atom, each of R^{11} and X^1 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an

aryloxy group or a heterocyclic group, and all of R^{11} and X^1 may be the same or different mutually. p is 1 or 2.)



(5)

(wherein M is a transition metal atom of the Group Ⅳ of the Periodic Table, Y^2 is a silicon atom, a germanium atom or a tin atom, each of ($R^{12}{}_n$-C_5H_{4-n}) and ($R^{12}{}_q$-C_5H_{4-q}) is a substituted η^5-cyclopentadienyl group, and each of n and q is an integer of 1 to 3. The respective R^{12} may be mutually the same or different, and indicate a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group. The position and/or kind of R^{12} in the substituted η^5-cyclopentadienyl group is selected so that a symmetric plane including M does not exist. Each of R^{13} and X^2 is a hydrogen atom, a halogen atom, an alkyl group, an aralkyl group, an aryl group, a substituted silyl group, an alkoxy group, an aralkyloxy group, an aryloxy group or a heterocyclic group, and all of R^{13} and X^2 may be the same or different mutually.)

72. A process for producing an α-olefin polymer, which comprises polymerizing an α-olefin with the α-olefin polymerization catalyst of claim 62.

73. A process for producing an α-olefin polymer, which comprises polymerizing an α-olefin with the α-olefin polymerization catalyst of claim 63.

74. A process for producing an α-olefin polymer, which comprises polymerizing an α-olefin with the α-olefin polymerization catalyst of claim 64.

75. A process for producing an α-olefin polymer, which comprises polymerizing an α-olefin with the α-olefin polymerization catalyst of claim 65.

76. A process for producing an α-olefin polymer, which comprises polymerizing an α-olefin with the α-olefin polymerization catalyst of claim 66.

77. The process for producing an α-olefin polymer according to claim 72, wherein the α-olefin polymer is an isotactic propylene polymer.

78. The process for producing an α-olefin polymer according to claim 73, wherein the α-olefin polymer is an isotactic propylene polymer.

79. The process for producing an α-olefin polymer according to claim 74, wherein the α-olefin polymer is an isotactic propylene polymer.

80. The process for producing an α-olefin polymer according to claim 75, wherein the α-olefin polymer is an isotactic propylene polymer.

81. The process for producing an α-olefin polymer according to claim 76, wherein the α-olefin polymer is an isotactic propylene polymer.